CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION

ATTACHMENT B to Order R7-2019-0030
PALO VERDE OUTFALL DRAIN AND LAGOON DDT AND TOXAPHENE IMPAIRMENT CONTROL PLAN

GENERAL WASTE DISCHARGE REQUIREMENTS
FOR
DISCHARGES OF WASTE FROM IRRIGATED AGRICULTURAL LANDS
FOR DISCHARGERS THAT ARE MEMBERS OF A COALITION GROUP
IN THE PALO VERDE VALLEY AND PALO VERDE MESA
Imperial and Riverside Counties

Problem Statement

Palo Verde Outfall Drain and Palo Verde Lagoon are listed according to federal Clean Water Act section 303(d) as impaired by pesticides dichloro-diphenyl-trichloroethane (DDT) and toxaphene, because concentrations of these pollutants in the waterbodies violate water quality standards. Pursuant to section 303(d), the state is required to develop pollutant Total Maximum Daily Loads (TMDLs) for surface waterbodies that are impaired and submit the TMDLs to the U.S. Environmental Protection Agency (USEPA) for approval. In lieu of a TMDL, staff of the California Regional Water Quality Control Board, Colorado River Basin Region (Colorado River Basin Water Board) have developed an impairment control plan through these General WDRs as an alternative to address the impairments of Palo Verde Outfall Drain and Lagoon by DDT and toxaphene (Impairment Control Plan).

DDT and toxaphene are man-made, legacy organochlorine pesticides. These pesticides were historically used extensively in the United States for agricultural and domestic pest control purposes, but are no longer legally sold in the United States and have not been used in the United States since the 1990s. In the environment, organochlorine pesticides such as DDT and toxaphene are slow to degrade. These pesticides have a tendency to attach to soil particles and are transported from point of application into receiving waters, mainly by hydrologic processes. They can and do bioaccumulate in aquatic life, including fish.

Extensive environmental monitoring indicates that DDT and toxaphene exceed the water quality objective for toxicity contained in the Water Quality Control Plan for the Colorado River Basin Water Board (Basin Plan). The most likely source for these organochlorine pesticides is from nonpoint source runoff from areas with high residual concentrations of these pesticides in soil. In Palo Verde Valley and Mesa, the main source is nonpoint source runoff from Irrigated Agricultural Lands.

Water Quality Standards

In California, “water quality standards,” as that term is defined in 40 Code of Federal Regulations section 131.2 consist of: (1) the designated beneficial uses for waters, and (2) narrative and/or numeric water quality objectives or criteria to protect those designated beneficial uses.

Surface waters in the watershed of Palo Verde Valley and Mesa include the Palo Verde Valley Drains, the Palo Verde Lagoon, and Palo Verde Outfall Drain. The beneficial uses for the surface waters include:

1. Water Contact Recreation (REC I);
2. Water Non-Contact Recreation (REC II);
3. Warm Freshwater Habitat (WARM);
4. Wildlife Habitat (WILD); and
5. Preservation of Rare, Threatened, or Endangered Species (RARE).[1]

Water quality objectives are limits or levels of water quality constituents or characteristics that are established for the reasonable protection of beneficial uses of water or prevention of nuisance within a specific area specified in the Basin Plan. Water quality objectives can be either numeric or narrative. Numeric water quality objectives set quantitative limits to the amount of a chemical that may be present in the environment without adversely affecting beneficial uses. Usually this type of limit is a maximum (not to exceed) concentration. Narrative water quality objectives set a desired or qualitative condition, and are interpreted using widely accepted criteria such as the California Toxics Rule (CTR) criterion (USEPA, 2000), the California Office of Environmental Health Hazard Assessment's (OEHHA) Public Health Goals (OEHHA, 2008), or other scientifically-defensible criteria or goals.

The Basin Plan for Colorado River Basin Water Board does not set numeric water quality objectives for DDT or toxaphene. Instead, the Basin Plan sets a narrative water quality objective for toxicity that states, "All waters shall be maintained free of toxic substances in concentrations which are toxic to, or which produce detrimental physiological responses in human, plant, animal, or indigenous aquatic life" and "No individual chemical or combination of chemicals shall be present in concentrations that adversely affect beneficial uses. There shall be no increase in hazardous chemical concentrations found in bottom sediments or aquatic life."

To interpret the narrative toxicity water quality objective for the protection of aquatic life beneficial uses (WARM, WILD, and RARE) and human health beneficial uses (REC I) from the adverse effects of DDT or toxaphene in water, staff selected: (1) the CTR criterion for human health protection when consuming organisms of 0.00059 ug/L for DDT's breakdown product, known as 4,4'-DDE, and (2) the CTR criterion for continuous concentration of 0.0002 ug/L for toxaphene. (USEPA, 2000.) Staff selected CTR criteria that are the most protective to ensure that all beneficial uses are supported.

To interpret the narrative toxicity water quality objective for the protection of human health (REC I) from the adverse effects of DDT or toxaphene for consumption of fish, staff selected the modified OEHHA Fish Contaminant Goals of 15 ug/Kg for total DDT and 4.3 ug/Kg for toxaphene. (OEHHA, 2008.) These fish consumption goals assume that the person or persons consuming the fish have an average body weight of 70 kilograms and consume 32 grams of fish per day over a 30-year time period over a 70-year lifetime. DDT and toxaphene are considered carcinogens; therefore, their risk level is set at one in a million.

To interpret the narrative toxicity water quality objective for the protection of aquatic life uses (WARM, WILD, and RARE) from the adverse effects of DDT in sediment, staff selected the freshwater sediment Probable Effects Concentrations of 31.3 ug/Kg for 4,4'-DDE and 572 ug/Kg for total DDT from USEPA's *Prediction of sediment toxicity using consensus-based freshwater*

[1] Only applies to the Palo Verde Valley Lagoon and Palo Verde Outfall Drain.

sediment quality guidelines, EPA 905/R-00/007. (McDonald et al., 2000.) Staff could not identify appropriate toxaphene evaluation guidelines to interpret the narrative toxicity water quality objective for aquatic life beneficial use protection in freshwater sediment.

Data Analysis

Available data for DDT and toxaphene concentrations in fish tissue, sediment, and water are displayed in Tables 1 to 4, except that no water concentration data is available for toxaphene.

Water concentration data (Table 1) shows that DDT is not usually found in Palo Verde Outfall Drain and Lagoon. When DDT is found in these waters, its concentrations are at or below analytical Reporting Limits (RLs). Because the RLs are above the selected CTR criterion, the data is inconclusive in confirming that DDT concentrations in water are below levels that produce adverse effects.

Table 1. DDT in Water (ug/L) in Palo Verde Outfall Drain (PVOD) and Lagoon (LG1) (Criteria is 0.00059 ug/L).

Date	*p,p*-DDT	*p,p*-DDE		MDL[a]	RL[b]
	PVOD	PVOD	LG1		
11/3/2003		0.002	0.002	0.001	0.002
5/4/2010	0.01			0.002	0.005

[a] MDL = Method Detection Limit
[b] RL = Reporting Limit

Fish tissue data (Table 2) shows that concentrations of DDT and toxaphene in Palo Verde Outfall Drain and Lagoon fish have reduced significantly from peak concentrations in the 1980s. Data collected since 2000 shows that DDT concentrations in fish are still above the OEHHA Fish Contaminant Goals. Data collected since 2000 also shows that toxaphene concentrations in fish are below the Reporting limits (RLs). Because the RLs are above the OEHHA Fish Contaminant Goals, Colorado River Basin Water Board staff cannot determine the full extent of the toxaphene impairment in fish tissue.

Table 2. DDT and Toxaphene in Fish Tissues (ug/Kg) Data in Palo Verde Outfall (PVOD) and Lagoon (LG1)

Date	DDT (Criteria is 15 ug/Kg)		Toxaphene (Criteria is 4.3 ug/Kg)	
	PVOD	LG1	PVOD	LG1
4/14/1986	1,475		1,200	
4/14/1986	421		<100[a]	
9/9/1987	30		<100[a]	
9/9/1987	186		<100[a]	
8/19/1991	226		130	
9/22/1992	207		<100[a]	
9/22/1992	416		<100[a]	
10/25/1995	387		140	
10/25/1995	182		<100[a]	
10/25/1995	46			
11/2/1996	24		<100[a]	
11/12/1998	25.3		<20[a]	
12/7/1999	33.2		<20[a]	

Date	DDT (Criteria is 15 ug/Kg)		Toxaphene (Criteria is 4.3 ug/Kg)	
	PVOD	LG1	PVOD	LG1
11/10/2000	12.6		<20[a]	
12/8/2004	11.4	9.42	<7.88[a]	<7.88[a]
2/10/2011	149.5			
2/10/2011	186.5		<40[a]	
4/19/2011	96.9		<40[a]	
4/19/2011	96.23			
11/15/2011	39.9		<40[a]	
3/27/2012	5.39		<18.4[a]	
11/17/2015	118.11			
3/1/2016	218			
3/1/2016	25.03			

[a] Detected not quantified, concentrations are below the reporting limits.

Available sediment data (Table 3) shows that concentrations of 4,4'-DDE are present in Palo Verde Outfall Drain and Lagoon sediment, but their concentrations are below the USEPA's freshwater sediment Probable Effects Concentrations.

Table 3. DDT Data in Sediment (ug/Kg) in Palo Verde Outfall Drain (PVOD) and Lagoon (LG1)

Date	4,4'-DDE (Criteria is 31.3 ug/Kg)	
	PVOD	LG1
5/8/2002		3.76
10/1/2002		2.74
4/8/2003	13	5.69
5/4/2004	2.82	
10/5/2004	11.7	
5/10/2005	4.5	3.06
10/25/2005	7.04	
5/2/2006	2.55	6.69
10/23/2007	8.96	9.6
4/22/2008		3.61
4/29/2009	4.23	2.21
10/20/2009	4.1	8.41
5/4/2010	5.26	5.35
10/5/2010		3.78
5/9/2011	7.72	
10/10/2011		2.94
5/8/2002		3.76

Numeric Targets

Numeric targets to attain the applicable water quality standards for DDT and toxaphene in Palo Verde Outfall Drain and Lagoon are displayed in Table 4. These numeric targets are set equal to OEHHA Fish Contaminant Goals, USEPA's freshwater sediment Probable Effects Concentrations, and the CTR water criterion described previously, with a three-year averaging period to account for short-term variations.

Table 4. DDT and Toxaphene Fish Tissues, Sediment, and Water Numeric Targets for PVOD

Constituent	Water (ug/L)	Fish Tissues (ug/Kg)	Sediment (ug/Kg)
4,4'-DDE	0.00059[a]		31.3[c]
Total DDT		15[b]	572[c]
Toxaphene	0.0002[a]	4.3[b]	

[a] USEPA, 2000
[b] OEHHA, 2008
[c] McDonald et al., 2000

The numeric targets in Table 4 are the most stringent of the guidelines or targets that have been recommended by the State Water Resources Control Board (State Water Board) during the 2012 303(d) List cycle and used in the USEPA-approved 2012 303(d) List.

DDT and toxaphene values in fish tissue in Table 4 assume an average body weight of 70 kilograms and a consumption rate of 32 grams per day (8-ounce serving per week) for a 30-year exposure over a 70-year lifetime. These constituents are carcinogens; therefore, the risk level is set at one in a million.

The estimated percent reduction needed to achieve the water and fish tissue numeric targets is displayed in Table 5. Percent reduction in water and fish tissue is calculated by dividing the required change in concentration (difference between the current concentration and the numeric target) by the current concentration, and then multiplying by 100.

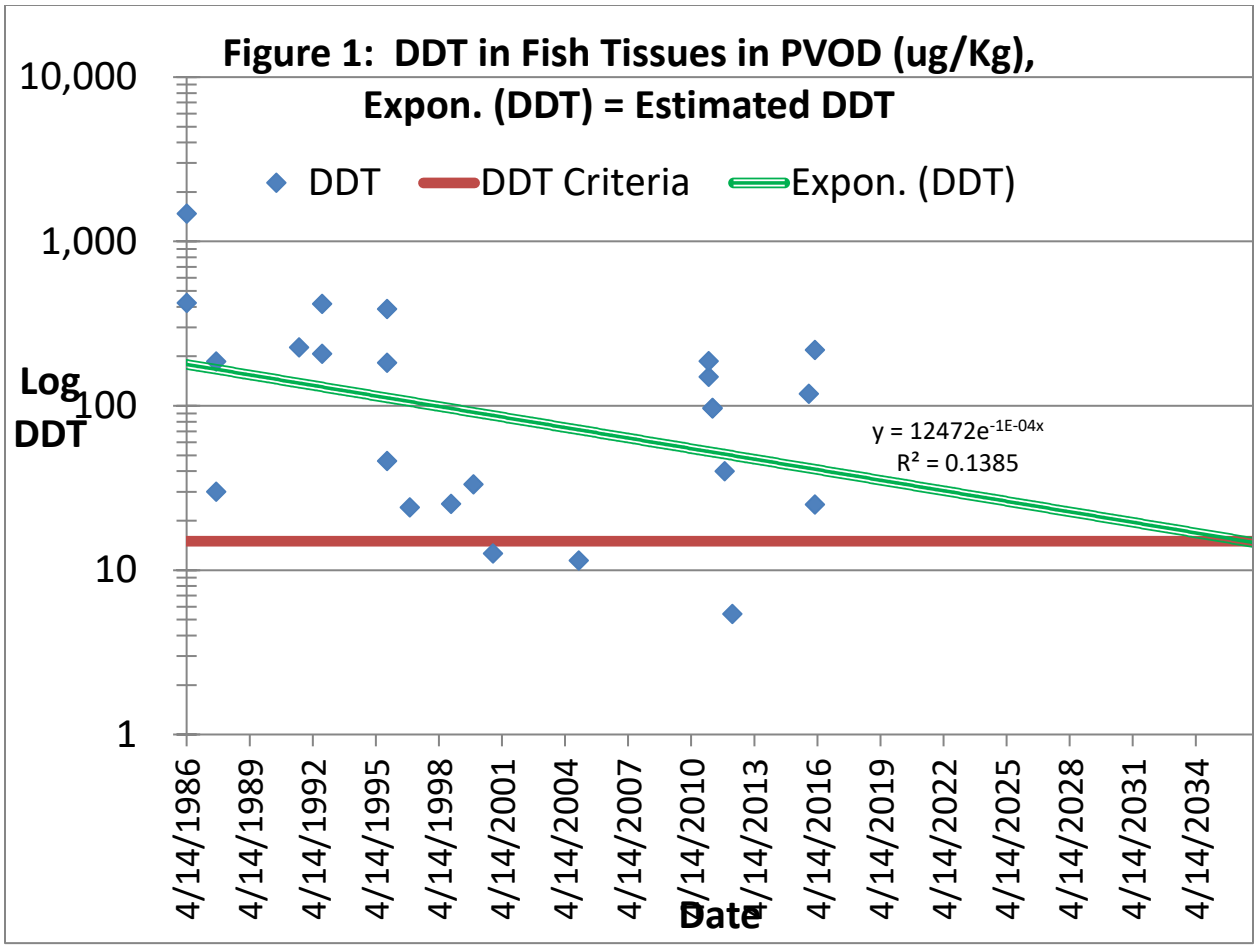
Table 5. Estimated percent (%) reduction needed for sources to meet DDT and Toxaphene water and fish tissue numeric targets in PVOD

Constituent	Water % Reduction	Fish Tissue % Reduction
4,4'-DDE	71	
Total DDT		88
Toxaphene		88

For DDT concentrations in water, data from November 3, 2003 for 4,4'-DDE (0.002 ug/L) (Table 1) was used to calculate the percent reduction. For DDT in fish tissues, the average of 2015 and 2016 data for Total DDT (118.11 ug/Kg in November 17, 2015, and 218 and 25.03 ug/Kg in March 1, 2016) (Table 2) was used to calculate the percent reduction of Total DDT in fish tissues. There is no estimated percent reduction needed for DDT in sediment because no sediment data was collected for Total DDT, and no sediment data violated the 4,4'-DDE numeric target in Table 5.

For toxaphene in fish tissues, the average detection limits from 2011 and 2012 data (40 ug/Kg in February 10, April 19, and November 15, 2011, and 18.4 ug/Kg in March 27, 2012) (Table 2) was used to calculate the percent reduction. There is no estimated percent reduction needed for toxaphene in sediment or in water, because no sediment evaluation guidelines were available and no water concentration data was collected to calculate the percent reduction.

Based on the DDT trend analysis (Figure 1), the estimated date to achieve the fish tissue numeric targets in Table 4 is December 2036.



Source Analysis

The main source of DDT and toxaphene in Palo Verde Outfall Drain and Lagoon is nonpoint source runoff from areas with high residual concentrations of these pesticides in soil. Nonpoint source runoff in the Palo Verde Valley and Mesa watersheds is predominantly from Irrigated Agricultural Lands. Nonpoint source inputs include the load from atmospheric deposition directly onto the waterbody, although this is a much smaller contribution compared to the load from agricultural runoff. There are no point source, National Pollutant Discharge Elimination System (NPDES)-permitted industrial facilities or publicly-owned treatment works (POTWs) that discharge to Palo Verde Outfall Drain and Lagoon.

The sources of DDT and toxaphene were investigated using several methods, including historical research as well as analysis of past pesticide use data and watershed land use. DDT and toxaphene possess similar chemical and physical characteristics. Like DDT, toxaphene binds to sediments in the environment. Both pesticides are carried by water flow from upstream locations to new downstream locations, where they settle and accumulate in the bottom sediments of waterbodies. Both pesticides accumulate in fish. Similar control measures that reduce the concentration of DDT in water, sediments, and fish to allowable concentrations will reduce the concentration of toxaphene in the environment.

As legacy pesticides, DDT and toxaphene have not been applied in the United States for many years, and there is no detailed historic use reporting data. Beginning in the late 1930s, DDT was

widely used to control insects in agriculture and insects that carry diseases such as malaria. At its peak in 1962, DDT was used on over 300 agricultural commodities. It was also used in residences as a mothproofing agent and to control lice. All registered uses of DDT have been banned in the United States since 1972. In emergency situations, DDT may still be used to control public health problems. (ATSDR, 2002.)

In California, the uses of DDT varied from the control of agricultural pests to the control of cockroaches in residences and mosquito abatement in neighborhoods. (CDFA, 1985.) Data documenting discrete DDT use is not available, since widespread reporting of pesticide use in California did not begin until 1974. DDT and its degradates are bound to sediment particles in the environment, and agricultural activities are the primary source of these pollutants in the Palo Verde Outfall Drain and Lagoon.

Toxaphene was first used in the 1940s. After the 1972 ban on DDT, toxaphene became the most heavily used pesticide in the United States. It was used primarily in the southern United States to control insect pests on cotton and other crops. It was also used to control insect pests on livestock and to kill unwanted fish in lakes. (ATSDR, 1996.) USEPA canceled the registration of toxaphene for most uses as a pesticide or pesticide ingredient in 1982. All registered uses were banned in 1990, and existing stocks were not allowed to be sold or used in the United States.

The applicable water quality standards for DDT and toxaphene are expected to be attained through continued implementation and improvement of sediment and pesticide management practices by Palo Verde Valley and Mesa farmers/growers.

Linkage Analysis

Palo Verde Outfall Drain and Lagoon are impaired by DDT and toxaphene, which has resulted in the presence of these pesticides in sediment and the tissue of fish. Organisms tend to accumulate these pesticides from their environment and to some extent through the consumption of organisms from lower trophic levels in the food-web that have also accumulated the pesticides. (Davis et al., 2007.) The concentrations of these pesticides in fish tissue have been previously associated with their concentrations in sediment. (CRWQCBCVR, 2010; CRWQCBSAR, 2006.) Since organochlorine pesticides have a strong tendency to bind to sediments, the transport of sediment is the primary pathway of pesticide from land use to the receiving waterbody.

A reduction of DDT and toxaphene loading into surface waters requires minimizing the sediment loading from areas where sediment is contaminated with organochlorine pesticides. As discussed in the source analysis, these pesticides are present as a result of various uses, mainly from historical Irrigated Agricultural Lands applications in Palo Verde Valley and Mesa watershed. Sediment loading from Irrigated Agricultural Lands in this watershed must be minimized to the maximum extent practical to achieve the numeric targets in Table 4, and therefore the water quality standards.

Allocations

The sediment and water load allocations for DDT and toxaphene are displayed in Table 6. These nonpoint source load allocations are set equal to USEPA's freshwater sediment Probable Effects Concentrations and the CTR water criterion described previously, with a three-year averaging period to account for short-term variations.

Table 6. DDT and Toxaphene Water Allocations and DDT Sediment Allocations for PVOD

Constituent	Water (ug/L)	Sediment (ug/Kg)
4,4'-DDE	0.00059	31.3
Total DDT		572
Toxaphene	0.0002	

The water and sediment load allocations in Table 6 are assigned on a concentration basis, with the goal of attaining the numeric targets identified herein for water and sediment, as well as for fish tissue. The load allocations apply to water and sediment entering Palo Verde Outfall Drain and Lagoon. Compliance will be measured according to achievement of all numeric targets (including fish tissue concentration). Allocations are assigned by requiring equal concentrations from all sources.

The allocations in Table 6 are applicable throughout Palo Verde Outfall Drain and Lagoon, and during all seasons of the year. Discharges from Irrigated Agricultural Lands shall not cause or contribute to exceedances of the DDT and toxaphene allocations in Table 6.

The natural source and wasteload allocations are set equal to zero, because there are no natural sources or known point sources of DDT and toxaphene in the watershed of Palo Verde Outfall Drain and Lagoon.

Margin of Safety

The margin of safety is incorporated into this Impairment Control Plan implicitly through the conservative approach employed by setting the numeric targets and load allocations equal to the desired water quality. If, during the implementation of this Impairment Control Plan, more stringent water quality objectives are adopted by the Colorado River Basin Water Board for DDT or toxaphene, staff will revise the numeric targets to better reflect the desired water quality, and the load allocations will also be set equal to these revised targets.

Critical Conditions

This Impairment Control Plan protects beneficial uses by reducing the concentration of DDT and toxaphene in fish tissue, sediment, and the water column to levels that are safe for aquatic life and human health-related beneficial uses. Because fish bioaccumulate DDT and toxaphene, concentrations in edible-sized, game fish will integrate their exposure over many years. As a result, overall average loading is more important for the attainment of water quality standards than instantaneous or daily concentrations of DDT or toxaphene. Load allocations in this Impairment Control Plan are assigned as three-year average concentrations and are protective during all seasons in both high and low flow conditions. This plan therefore protects critical conditions.

Implementation and Monitoring

This Impairment Control Plan is implemented by these General WDRs. The parties responsible for implementing the General WDRs are Irrigated Agricultural Lands Dischargers in Palo Verde Valley and Palo Verde Mesa. The General WDRs require these parties to continue implementing effective sediment management practices to achieve the load allocations for DDT and toxaphene in Table 6 by December 2036. The Order also requires the parties to monitor Palo Verde Outfall Drain and Lagoon for DDT and toxaphene in fish tissues once a year for three years using methods with analytical RLs below the numeric target values, if available. Monitoring data will be

used to identify and implement management practices that effectively control DDT and toxaphene, and achieve compliance with the load allocations. Colorado River Basin Water Board staff will assess all available monitoring data to determine the achievement of water quality standards, the effectiveness of management practices, and the necessity of any revisions to this Impairment Control Plan.

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